COVER PAGE

Quality Assurance Project Plan
Jordan Creek Watershed HUC 1705108
Mercury Monitoring Project
July-September 2005
Idaho Department of Environmental Quality

This document reflect revision completed after August 1, 2005. Please contact the Project Manager for updated information and further justification for changes from previous versions.

Signature Page

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1.0 Organization/Document Review

1.1 Peer Review

The following peers have reviewed the draft QAPP ver 04-27-05 and ver 5-06-05:

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1.2 Task Organization

The Boise Regional Office of DEQ will oversee the mercury monitoring work in the Jordan Creek watershed, within Idaho. The Project Manager will oversee programmatic issues such as coordination with other organizations including IDHW, EPA and state of Oregon. For samples sent to the EPA Lab, the EPA Quality Assurance Officer and senior chemist will ensure quality assurance. The Project Manager will coordinate with the contract laboratory to ensure quality assurance for samples sent for sediment and methyl mercury analysis.

The EPA lab will be responsible for analyzing water for total and dissolved mercury and fish tissue for total mercury. Pore water samples (Tier II) obtained from sediment samples will be processed and the EPA lab will complete analysis for total and dissolved mercury on those samples. Pore water analysis will not be conducted during Tier I sampling.

Sediment samples will be analyzed for total mercury and methyl mercury. Sediment analysis also includes the extraction of pore water from the sediment samples. In addition, values for sediment pH, bulk density, and particle size will be obtained. Microbial assays for potential methyl mercury production, methyl mercury demethylation and microbial sulfate reductions will be conducted. Final determination of the Tier II approach has not been determined. An appropriate laboratory has not been identified at this time and additional discussion is ongoing.

The IDHW lab will measure total organic carbon (TOC), dissolved organic carbon (DOC), hardness and alkalinity. Temperature, pH, dissolved oxygen (DO), redox, conductivity, and fish identification, length, and weight will be measured in the field by DEQ staff. The filleting and grinding of fish will occur at a secure “clean” laboratory at Idaho Department of Environmental Quality Boise Regional Office.

1.2.1 Project Coordinators

For the Jordan Creek SBA-TMDL project and the fish tissue assessment, the Project Manager will serve as the project coordinator, and will serve as the scientific lead for this project. The coordinator and the scientific lead will be responsible for the technical and conceptual design of the project. To assure the highest quality assurance, the Project Manager will be the sole contact with all laboratories, and is responsible for outlining tasks for private lab, selection of private labs as directed by the Fiscal section of DEQ, contract development, coordination for sample submittal, discussion of quality assurance issues and review of analytical results.

1.2.2 Field Operations

Hawk Stone, DEQ, will serve as the coordinator of field operations and be responsible for the proper collection of samples, field data, and field QA/QC. The Project Manager along with the Field Operation Line Manager will also be responsible for coordinating field logistics, securing permits, and preparing reports for field operations.

1.2.3 Sample Collectors

DEQ staff will collect samples from predetermined locations and follow the sampling protocols identified in this document.

1.2.4 DEQ Laboratory QA/QC Fish Tissue Processing Coordinator

DEQ Technical Services has been contracted to conduct the fish tissue preparation. Xin Dia will coordinate DEQ Lab activity, conduct quality assurance during fish tissue preparation and coordinate with the Project Manager on sample delivery, processing and preparation for shipment.

1.3. Funding Codes

Table 1 shows the appropriate funding codes to be used for the mercury sampling and assessment for the Jordan Creek watershed.

Table 1. Appropriate Agency Codes. Jordan Creek Watershed

Agency/Item	Code
Idaho DEQ	
General	TM49 4003 42098 5145 700 23
Per Diem	TM49 4003 42098 5396 700 20
Wages	TM49 4003 42098 5145 700 23
Capital Outlay	TM49 4003 42098 6899 700 23
Travel	TM49 4003 42098 5399 700 20
Purchases	TM49 4003 42098 5725 700 22
IDHW Laboratory	8446
US EPA	
General EPA	
Project Code	WTR-147A
Account Code	0506B10P202BD4C

Approximately $33,000.00 has been acquired through an EPA Grant for support of the Jordan Creek mercury monitoring effort. The funding will not be available until the beginning of the federal Fiscal Year: October 2005. However, the EPA Lab is available to conduct mercury analysis prior to the October date, and at no charge to the state of Idaho or to the grant. Once the QAPP is approved by the EPA Lab, dates will be established for sample collection and shipping. The willingness of the EPA Laboratory to complete the mercury analysis in July will be a critical component for Tier II monitoring. With current information concerning the snow pack and expected runoff in the watershed for Water Year 2005, the lack of water will affect many aspects of this study and Tier II monitoring.

A proposed budget for personnel costs, equipment needs and laboratory support is located in Appendix C.

1.4 Scheduled Timeline of Task Completions

Table 2 shows the timeline for the tasks to be completed within the scope of this project.

Table 2. Timeline for Task Completions. Jordan Creek Watershed. Jordan Creek Watershed[2]

Tasks/Month	April	May	June[1]	July	August	Sept	Oct
Draft QAPP Completed	April 30						
Final QAPP Completed		May 15					
Approval of QAPP		May 30					
1669 Training		May 26					
Equipment/Material Ordered			June 8				
Equipment/Material Received			June 17				
Water/Sediment Monitoring			*June 20- 23*	*July 11-13* *July 18-20* *July 25-27*	*Aug. 1-3* Aug. 8-10		
Ship Water/Sediment Samples			*June 21-24*	*July 12- 14* *July 19-21* *July 26-28*	*Aug. 2- 4* Aug. 9-11		
Fish Tissue Collection			June 27-30				
Fish Laboratory Prep/Processing Samples			June 28- July 1				
Ship Fish Tissue Samples				July 5			
Field/Lab Review, Verification, Validation				*July 6-7*		Sept. 15	
Coordinate with Labs on QA/QC Issues				*July 8*	Aug. 30	Sept. 1	
Lab Data Result Review					*Aug 30*	Sept. 30	
Data Analysis					*Aug 5-15*	Sept 15-20	
Laboratory Data Review, Verification, Validation					*Aug 20- 25*	Sept. 20-25	Oct. 1
Preliminary Data Report					*Aug 30*		*Oct. 1* Oct. 15
Draft QAPP Amendment Tier II							*Oct. 15* Oct. 30

[1] **Strikethrough represents altered dates from original** [2] *Dates Changed from Original QAPP*

1.4.1 Modifications of Original Document/Timeframe

Surface water and sediment monitoring scheduled to begin on June 20, 2005 was postponed to June 23rd due to the lack of 0.45 micron capsule filters which had been ordered the previous week. All other materials ordered that week had arrived by the 17th, except the filters. Monitoring did begin on the 23rd as rescheduled, however, by the night of the 23rd it had become apparent the contract for the methyl mercury water analysis and the sediment analysis had not been completely processed. Samples were again collected on the 24th, but by the 25th it once again became more apparent that there was not a contract in place for a lab to send the samples too for analysis. By the 29th of June all recommended holding times for unpreserved samples had been exceeded.

A new contract was finally developed by August 1, 2005 for the methyl mercury and sediment analysis and monitoring was scheduled to begin on August 8th. Monitoring was completed by August 10th with all samples being shipped within 24 hours, and arriving at the respected labs within the recommended 48 hour holding time for unpreserved samples.

One of the primary objectives of this study was to obtain tissue, water and sediment samples all within a short time period. The original document had established a 10-14 day period to collect all parameters. It had been calculated this window would allow for the limited resources available to conduct the monitoring, and still be representative of similar climatic and hydrologic conditions.

2.0 Problem Definition/Background

2.1 Background

DEQ is in the process of organizing information and analyzing data for the Jordan Creek Subbasin Assessment (SBA). The purposes of the SBA are several and include; evaluating the status of beneficial uses determining compliance to numeric and/or narrative water quality criteria in the Idaho Water Quality Standards (WQS) and State of Oregon WQS identifying impairment to designated and existing uses identifying pollutant(s) impairing uses determining water quality targets, or surrogates, to achieve full support of beneficial uses, and identifying sources associated with pollutant(s).

Information provided in the SBA will determine whether a Total Maximum Daily Load (TMDL) will be required for water bodies not supporting beneficial uses in the Jordan Creek watershed. If required, the TMDL will establish waste load allocations (WLAs) for point sources if any exist in the watershed, load allocations (LA) for nonpoint sources and a margin of safety (MOS) to offset future growth for those pollutant(s) determined to be impairing beneficial uses.

2.2 Preliminary Source Assessment

Jordan Creek is the only water body within the Idaho portion of the watershed that has mercury listed as a pollutant of concern, in addition to other pollutants. Available mercury data for water column, stream sediments and fish tissue date back to the early 1970's with the latest data collected in 2005. The 2005 data is associated with the Delamar Mine storm water

discharge permit (Kinross 2005). The Delamar Mine monitoring focuses on storm water discharge from the operation, but does include some chemical, biological and physical water quality in Jordan Creek. Historic studies done in the watershed include; an extensive water column, fish tissue, sediment and soils study conducted by Hill *et al.* (1973), a Department of Interior, Bureau of Land Management (BLM) study to characterize mine tailings and stream sediments associated with federally managed lands (Seronko 1995), the Environmental Impact Statement for the proposed Stone Cabin Mine (CH_2M Hill 1993) and a research project on existing information within the entire Owyhee watershed, which included data collected in the three states of Nevada, Idaho and Oregon (Koeber 1995).

2.3 Project Task/Description

The two main goals of this study are to acquire updated fish tissue mercury data and to begin to identify and/or verify sources/location of mercury in the Jordan Creek watershed. In this study, water, sediment and fish tissue samples will be collected from sites throughout the Idaho portion of the watershed. Fish tissue data will be used to assess the spatial distribution of fish and fish tissue mercury levels. Water and sediment samples will be collected to assist in identifying possible sources and to determine if there any correlation between tissue data and mercury levels in the water column and/or stream sediments. The number of samples generated by past studies is small and no correlation could be determined between the three media.

The sampling will consist of two major efforts; the first, Tier I, will determine the spatial distribution of mercury in fish tissue, sediments and water. With the use of data obtained in the Tier I effort, Tier II sampling will be narrowed to two or three sites where more intensive evaluation can occur. Tier II sites will focus on the interface between mercury levels in the sediments, fish and water (Tier II methods and related material will be a separate document and/or an amendment to this QAPP).

The first phase of sampling (Tier I) will consist of a one time monitoring event where samples will be collected from distinct locations along the mainstem Jordan Creek, Flint Creek and Louse Creek which will include downstream of legacy mining activity, and downstream of areas where known milling activity included the use of mercury for extraction. In addition, one site, outside the mainstem, will be located in a watershed where no mining activity has been documented. For Tier I, fish tissue collection will be conducted at eight (8) sites which have been selected based on the above criteria. An additional four (4) sites will receive sediment and water sampling only.

The Tier II monitoring effort will narrow down possible mercury issues in the watershed, and address concerns about the interface between the biota, sediment and water, identify possible legacy deposition patterns of mercury, identify areas of concern as sources and hopefully identify areas of bioaccumulation. Depending on results from the Tier I monitoring effort, Tier II monitoring may be narrowed to two of three sites.

For both Tiers I and Tier II monitoring events, sampling parameters will remain the same. However, during the Tier II monitoring three additional parameters will be added, intergravel (sediment) water quality (pore water), low bank sediments (wetted) and stream sediment cores.

Tier II monitoring will be conducted twice. Additional protocols for Tier II will be developed later.

2.3.1 Objectives

Objective 1: Obtain current Mercury fish tissue data and spatial distribution in the watershed, and identify areas where exceedances of the Mercury Fish Tissue Criteria might be occurring. Tier I and Tier II Monitoring.

Rationale

Historic fish tissue data showed total mercury concentrations ranged from 0.03 ppm to 2.40 ppm and averaged 0.49 (median 0.35 ppm) total mercury (Hill *et al*.1973 and CH_2M Hill 1994). At present time, it is expected Idaho will adopt EPA recommended criteria of 0.30 mg/kg methyl mercury concentration in fish tissue (EPA 2001). Methyl mercury is the bioaccumulative state of mercury. It has been determined that methyl mercury component in fish tissue is from 85-99% of the total mercury level.

Hill *et al*. (1973) showed mercury levels highest in bottom feeding fish, namely suckers, and averaged 0.90 ppm. Trout had levels averaging 0.32 ppm. In the Flint Creek drainage, Hill *et al.* (1973) noted that sculpin species averaged 0.72 ppm, much higher than what the levels were in sample sites in Jordan Creek. Hill *et al.* (1973) also noted that mercury levels in suckers and trout were lower in Flint than the other portions of the watershed. However, the average for all fish in Flint Creek was 0.32 compared to 0.51 in Jordan Creek.

In addition to mercury levels found in Jordan Creek within Idaho, high levels in fish tissue have also been found in the receiving waters in Oregon. Fish consumption advisories have been issued for Antelope Reservoir and lower Jordan Creek. Hill *et al.* (1973) reported higher concentrations in the overall population, averaging 0.93 ppm. Antelope Reservoir had an average fish tissue mercury level of 0.90 ppm. Mercury levels in the reservoir may be associated with the sediment and ionic mercury loads from the Jordan Creek watershed. The reservoir in-turn may provide a more favorable environment for methylation. The reservoir is stocked with water from Jordan Creek for late season irrigation use, but would not naturally or topographically be within the upper Jordan Creek drainage.

Consumption advisories have also been issued for the Owyhee River and Owyhee Reservoir. Both water bodies receive inflows from Jordan Creek (Koerber 1995). Another reservoir, Cow Lakes, has data indicating that fish tissue mercury levels exceed the 0.350 ppm limit set by the state of Oregon Department of Human Services. Total mercury levels in Cow Lakes Reservoir ranged from 1.250 to 1.510 ppm (IN: Hill *et al*. 1973). Later evaluations of Cow Lakes Reservoir in 1980's by the state of Oregon indicated mercury levels were not exceeded (EPA Communication 2005) No advisory has been issued. It should be noted that Jordan Creek does not provide water to this reservoir, which receives runoff from Cow Creek and Mahogany Creek watersheds.

Historic fish tissue data indicated no trend in spatial distribution of fish contamination. Mercury levels exceeding the fish tissue criteria were found in headwaters streams near Silver City, Idaho, and as far downstream as the confluence of Jordan Creek with the Owyhee River near Rome, Oregon. Figure 1 shows the location, within Idaho, of the collection sites and the levels found in fish tissue.

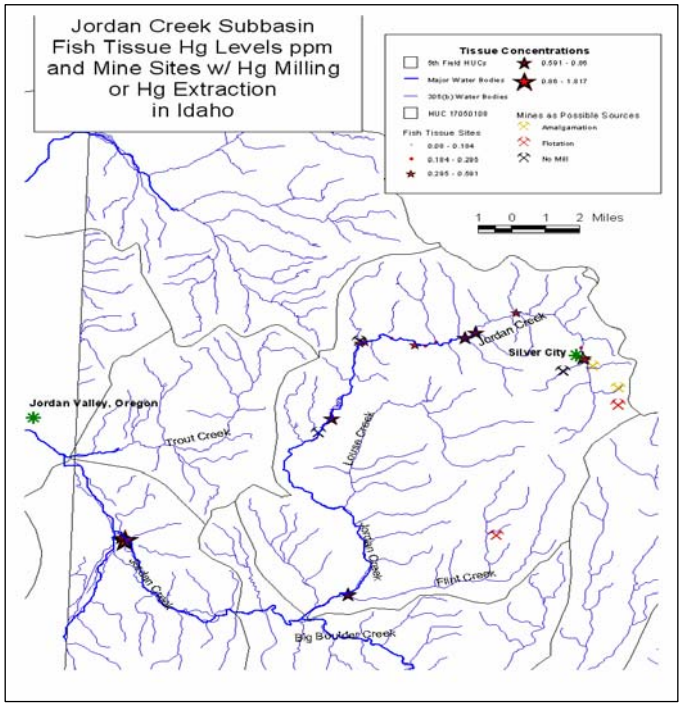

Figure 1. Fish Tissue Hg Levels Hill *et al*. (1973).

Tier I fish collection will cover a variety of locations and include a possible background location with no significant mining in the watershed. Along with mainstem Jordan Creek, three sites will focus on smaller tributaries such as Louse and Flint Creeks. These smaller water bodies may provide spatial distribution of tissue information for young of the year (YOY), larger fish and identify spawning areas. It is not expected larger fish will be a good indicator for possible sources since most adult species are not year round residents of one location, but will migrate to larger lower elevation segments when water temperatures cool, returning to the smaller cooler water bodies for spawning and warm water temperature refuge.

Besides determining possible spatial distribution, this information will provide additional information of mercury levels in fish based on community structure and functional feeding groups. While salmonid species rely mostly on benthic macroinvertebrates and adult insects, bottom feeders are more of an opportunistic feeder.

Considering the advanced age of fish tissue data collected in Idaho's portion of the Jordan Creek watershed, more updated information is required. Additionally, the mercury criteria in the Idaho WQS have changed from water column based to fish tissue, based on human health effects.

Objective 2: Identify additional areas with detectable Mercury concentrations in stream sediments and/or water column samples. Tier I Monitoring

Rationale

Historic water quality data for mercury did not indicate water column concentrations at a level that would exceed the current and most stringent WQS, 0.15 µg/l. Most water quality data presented by Hill *et al.* (1973) showed that water column concentrations were below detectable levels. Data presented in the 1998 STARS (EPA 1998) for water column samples showed only one station above the detectable level.

This is not surprising since elemental mercury (Hg^o) does not demonstrate great solubility or mobility in water. Ionic forms (dissolved mercury {Hg^{++}}), or reactive gaseous Mercury (RGHg) within the water column will easily attach to particulates and be re-deposited, released to the atmosphere (evasion), form complex salts or be reduced to elemental Hg^o or mercuric sulfide HgS. Methylation is the process which ionic mercury (Hg^{++}) is transformed to the organic form of methyl mercury $(CH_3Hg)^+$ or demethyation where methyl mercury forms dimethyl mercury ($(CH_3)^2Hg$). It should also be noted that methyl mercury can be changed to inorganic forms through demethylation, forming such compounds as mercuric sulfide (HgS).

The key to the release of the organic mercury to an aquatic ecosystem is the formation of ionic mercury either from natural occurring forms of mercuric sulfides (cinnabar) or from elemental mercury introduced from anthropogenic sources. The formation of ionic mercury can be accomplished in many different means through biological, chemical and/or physical conditions available for oxidation. Once in the ionic form, ionic mercury in water may be released to the atmosphere (evasion), attached to particulates (HgP), methylated, bound with other inorganic substances, transformed into complex salts or be reduced back to elemental mercury or mercury sulfide.

It is the presence of sulfide reducing bacteria and their production of enzymes that dictate the transformation of mercury from its inorganic to its organic form. It is the primary purpose of these enzymes to make inorganic forms of mercury more soluble (methyl mercury, ionic mercury), which are more easily transported through the water column. Methyl mercury is then available to the biota through absorption, ingestion, inhalation or other means. Methyl mercury will bioaccumulate through the food chain, meaning mercury levels will increase if the primary food source levels remain the same. Methyl mercury is effectively taken up by aquatic biota and bioconcentrations factors in the order of 10^4 to 10^7 have been documented (Ullrich, Tanton and Abdrashitova 2001). While methyl mercury accounts for 10-30% of total mercury in the water column, in fish tissue, methyl mercury account for 85-95% of the total mercury. Typically in sediments methyl mercury accounts for 1-1.5% of the total mercury. However, pore water levels can be much higher (Ullrich, Tanton and Abdrashitova 2001).

All this information indicates that mercury in the water column would probably be found in close proximity to either the primary source, elemental mercury, or to the source of methylation and ionic forms of mercury. Any transport of mercury in elemental form would be associated with high flow periods and/or the movement of bedload material. Transport of ionic mercury would be associated with suspended sediments or organic material (i.e. organic carbon) which could occur at any time. Additional references and literature is located in Appendix A.

Identifying areas with detectable levels of mercury in the water column and/or sediments through a watershed screening process will assist in confirming data on historic deposition patterns and update available data.

Objective 3: Determine correlation between fish tissue data and possible sources (i.e. historic deposits, tributaries, areas of concern). Tier I and Tier II Monitoring.

Rationale

It is not expected that larger fish will be a good indicator for possible sources since most adult species are not year round residents of one location. Larger adult fish will migrate to larger lower elevations segments when water temperatures cool, returning to the smaller cooler water bodies for spawning and summer time refuge from warmer water temperature in lower elevation segments.

The collection of young of the year (YOY) salmonid species will assist in identifying areas of concern for methyl mercury production (methylation). Salmonid YOY tend to remain in the immediate area after emergence, but may migrate a short distance for rearing and development. A general characteristic of YOY salmonid species is "hunkering" down in the gravels of a streambed for protection from larger predatory fish. In addition, their primary food source is benthic macroinvertebrates. These general characteristics of YOY salmonid species will make a good indicator of exposure over short duration (Mason *et al.* 2005). The data may be most useful in identifying areas of elemental or inorganic mercury deposits, areas of methylation, and provide a more detailed analysis of mercury levels and uptake in fish based on community structure and functional feeding groups.

Another target group is sculpin species. Sculpin tend to be a bottom dweller, but usually require clean gravel-cobble substrate and good water quality. As with trout species, their primary food source is benthic macroinvertebrates. However, unlike salmonid species, their primary home range is limited with little migration from and to different water bodies. The collection and analysis of sculpin mercury levels may assist in identifying areas of methylation and possible primary source of historic elemental and ionic mercury deposition.

Objective 4: Identify spatial depositional pattern of mercury in stream sediments and wetted streambanks soils. Tier II Monitoring

Rationale

As discussed above, any transport of mercury in elemental form would probably be associated with high flow periods and/or the movement of bedload material. The transport of ionic mercury would be associated with suspended sediments or organic material (i.e. organic carbon) which could occur at any time. Since it is the ionic form that appears to be the greatest

concern, the distribution and deposition from the main source conceivably could encompass the entire streambed and floodplain below the primary source. If detectable levels, or levels above background, are found in the water column, it is probably associated with high concentrations within the sediments, either elemental or ionic.

A study conducted in Steamboat Creek, Nevada (Stamenkovac *et al.* 2004) showed historic use of mercury has had a lasting effect on spatial distribution in that watershed. The study conducted in 2001 and 2002 attempted to characterize the sediment and streambank mercury levels throughout the water body and to identify areas of methylation. Stamenkovac (2004) concluded there was no indication that mercury levels in stream sediments decreased as compared to upstream sites, which showed the release from the primary source gets widely distributed, and in-turn becomes sources for further contamination, a lasting legacy from the primary source.

Data collected by Hill *et al.* (1973) and EPA (STARS 1998) showed mercury levels in sediments within the Jordan Creek and other tributaries are above background levels. This may indicate the headwater of the watershed is the primary source of mercury for the watershed, including Antelope Reservoir and the Owyhee River. Some of the sediment data indicate the primary source of mercury may still be present in the watershed and will continue to provide a continuous mercury load of ionic mercury to the downstream segments. Additional information from the state of Oregon has shown Antelope Reservoir contains fish that exceed EPA criteria for fish tissue. Studies have shown that lakes and reservoirs act as a sink for mercury and a source for methyl mercury. The primary source of water for the reservoir is Jordan Creek.

Identifying both the depositional patterns of mercury throughout the watershed and the primary source will assist in understanding the transport of mercury and what form is of primary concern for transportation.

3.0 Special Training/Certification

As part of the stepped up evaluation of mercury contamination and the human health consumption advisories, Idaho DEQ is conducting additional studies throughout the state. These studies include gaining a more comprehensive understanding of mercury sources which include atmospheric deposition. The air quality section of Idaho DEQ is currently conducting wet atmospheric depositional monitoring at certain location throughout the state. To enhance Idaho DEQ's ability in mercury monitoring, the state has contracted with Frontier Geosciences Inc. to provide training in EPA Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Level (EPA 1996). The training session is scheduled for May 26, 2005 in Boise, Idaho. The Project Manager, Field Operation Manger and all appropriate DEQ Laboratory personnel will be attending this training.

To comply with Idaho Department of Fish and Game requirements, the collection permit issued to DEQ for the annual beneficial uses reconnaissance program (BURP) will be modified to address the "taking" of the required number of fish to conduct an adequate and representative sampling for fish tissue mercury levels in the Jordan Creek watershed.

4.0 Documents and Records

4.1 Document Control

Revision of the QAPP prior to final approval by EPA and the Quality Director (DRAFT QAPP) will be discussed with the Project Manager. Written requests for revisions will document rationale for changes, estimate of additional costs associated with requested revisions, estimate of additional recourses required for requested revisions and description of possible affects revisions may have on project's quality assurance and quality control. Electronic changes to the DRAFT QAPP can only be made by the Project Manager and/or Quality Director. Tracking of requested revisions will be conducted by the Project Manager. Any revisions accepted will be discussed between the, Quality Director, Project Manager and Line Managers.

Revision of the QAPP, after approval by EPA and DEQ's Quality Director, can only be accepted through consultation with the Project Manager. Revisions must be well documented through the forms located in Appendix B. Electronic changes to the QAPP can only be made by the Quality Director and the Project Manager.

Versions of the document will be identified by the last date of revisions (e.g. Jordan QAPP ver.4-27-05) and is located in the header of the document. Acceptable revisions can only be made by the Quality Director and/or the Project Manager. All changes will be well documented.

4.2 Field Documentation Control

The Field Line Manager and the Project Manager will provide field staff a hard copy of the QAPP for their review. Field staff will be provided an adequate timeframe to review the document. The field staff will be briefed on roles and responsibilities of each individual to carry out the objectives stated in this document. Any questions or concerns will be addressed by the Field Line Manager and the Project Manager prior to any fieldwork. Each field staff personnel will be required to have in their procession a copy of the document during monitoring events.

In the perfect world, all goes well while conducting field surveys, collecting of samples, storing samples and transporting. In the real world, everything that can go wrong will and everything will go wrong at the same time. Preparing for the worst and expecting it, can make unforeseen situation manageable.

If resources allow, backup instruments and equipment should be available for field crews while in the field. Any changes of instruments or equipment will be documented and all instruments and equipment then used will be calibrated or decontaminated as described in this document. At no time will the lack of proper instruments and/or equipment compromise the integrity of the sampling effort or the quality controls outlined in this document.

Field records including field measured parameters, observations, equipment calibration will be maintained in a field notebook. All information entered by the field scriber will be discussed and verified by the Field Line Manager. Any issues concerning daily activity will be discussed

with the Project Manager. Any correction to data will be discussed prior to the next day's activity.

Raw data collected in the field will be entered into an Excel Database at the end of the week's activity. The final end product for all field documentation will be the tracking of daily activity from field staff to Line Manager to the Project Manager. Further data management for field observation will be conducted by the Project Manager.

4.3 DEQ Laboratory Documentation Control

The DEQ Laboratory QA Manager and the Project Manager will provide laboratory staff a hard copy of the QAPP for their review. Laboratory staff will be provided an adequate timeframe to review the document. The laboratory staff will be briefed on roles and responsibilities of each individual to carry out the objectives stated in this document. Any questions or concerns will be addressed by the Laboratory QA Manager and the Project Manager prior to any laboratory work.

Laboratory records including chain of custody, observations, equipment condition will be maintained in a laboratory notebook. All information entered by the Laboratory QA Manager concerning issues for the daily activity will be discussed with the Project Manager. Any correction to data will be discussed prior to the next day's activity.

The Laboratory QA Manager will provide written documentation of daily activity, including sample tracking, chain of custody documentation, sample identification and tracking through sample processing, sample preparation and storage and shipment of sample.

4.4 Sample Analysis Documentation Control

Outside laboratory support (i.e. Idaho Department of Health and Welfare Laboratory) will conduct documentation of sample chain of custody, sample tracking, sample analysis, data entry, data storage and data reporting as described in internal QA/QC procedures. Any issues concerning internal QA/QC procedures or activity prior to delivery will be well documented and discussed with the Project Manager.

5.0 Quality Assurance/Quality Control (QA/QC)

5.1 Data Quality

Data quality objectives for total mercury and methyl mercury water sampling are as follows: Transport or transfer blanks for each group of samples.

1. A laboratory blank for each group of samples.
2. Matrix spike and a matrix spike duplicate for 10% of the samples collected.
3. Field replicates for 10% of the samples collected (may not apply to fish tissue samples)
4. A quality control spike sample of known quality and concentration for Laboratory comparison (CCV) every 10 %, and secondary source standard once per analytical run.

5.2 Data Quality Assessment

5.2.1 Precision

Precision is a measure of the scatter of the data when more than one measurement is made on the same sample. Significant differences in precision can be measured depending on when the sample was split.

"Duplicate - usually the smallest number of replicates (two) but specifically herein refers to duplicate samples, i.e., two samples taken at the same time from one location."

"Replicate - repeated operation occurring within an analytical procedure. Two or more analyses for the same constituent in an extract of a single sample constitute replicate extract analyses."

Precision is commonly attributed to sampling activities and/or chemical analysis. Duplicate samples are collected in the field to assess precision attributable to sampling activities. Replicate analyses are performed with each test to assess data variability attributable to lab analysis. Matrix spike/matrix spike replicates are used on analyses where contaminants are not routinely detected. Matrix spike/matrix spike replicates are performed at the same frequency and control criteria as lab replicate analyses. Precision will be expressed as the relative percent difference.

The precision criterion is ±50% Relative Percent Difference (RPD) between duplicate field samples for concentrations greater than five times the minimum reporting limit (MRL). When the concentration is less than five times the MRL the precision criterion used is +/- the MRL for the average between the field duplicates. Field duplicates will be collected at a ten percent (10%) frequency and are used as a quality control check on the overall monitoring system. The QA Chemist reviews field duplicate precision and corrective action is initiated when poor precision is obtained.

The precision criteria for laboratory replicates is +/-20% RPD for concentrations greater than five times the MRL and for concentrations less five times the MRL the precision criteria is +/- the MRL for the average between the laboratory replicates. There will be a minimum of ten-percent laboratory replication.

The Relative Percent Difference (RPD) is calculated using the equation:

$$\text{RPD} = \frac{2(x_s - x_d)}{x_s + x_d} \times 100\%$$

Where:
xs = result for the sample and
xd = result for the duplicate sample. The units of xs must equal to those of xd.

5.2.3 Accuracy

Accuracy is a measure of the difference between observed test results and true sample concentration. In as much as true concentrations are not known, accuracy is inferred from recovery data determined by sample spiking and/or the analyses of reference standards. Spiked samples will be run at a 10% frequency or one per set of samples, whichever is greater. The criterion for spike recovery is 60% - 140%.

Percent recovery is calculated using the equation:

$$A = \frac{x_{ss} - x_s}{T} \times 100\%$$

Where:
A = recovery for the added spike;
xss = result for the spiked sample;
xs = result for the sample;
T = true value of the added spike

Expected and acceptable ranges to measure precision and accuracy are located in Table12. It should be noted that the number of samples to be submitted with the Jordan Creek Tier I study may not allow for an adequate number of samples to judge precision and accuracy to the extent that a long-term study may have.

5.2.4 Data Representativeness

Representativeness is evaluated by assessing the accuracy and precision of the sampling program and expressing the degree to which samples represent actual site conditions. The representativeness criterion is best satisfied by confirming that sampling locations are properly selected, sample collection procedures are consistently followed, and a sufficient number of samples are collected. All sampling procedures will follow the procedures outlined in Section 8.0

5.2.5 Data Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. Throughout this project, the same analytical procedures will be used and the same laboratory will be used to analyze the samples in an effort to ensure data comparability. For field aspects of this project, data comparability will be achieved by using standard methods of sample collection and handling, as listed in Section 8.0.

5.2.6 Data Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system compared to the amount that was expected to be obtained. It is defined as the total number of samples taken for which valid analytical data are obtained divided by the total number of samples collected and multiplied by 100.

This project would like to achieve 100% complete data set for all analyses. It is understood that due to unforeseen circumstances some results may be lost do to failure of equipment,

transportation problems, data results misplaced or any number of situations that may not be in control of the QA managers. Realistically, a target of 90-95% completeness would be acceptable.

Field and laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 90% percent complete for this study, analyses will be evaluated on a case-by-case basis to determine whether the project needs to continue sampling. An example of data completeness is seen in Table 3.

Table 3. Example of Measure of Data Completeness. Jordan Creek Watershed.

Parameter	No. Valid Samples Anticipated	No. Valid Samples Collected & Analyzed	Percent Complete
Water			
Total Hg			
Diss. Hg			
TOC			
Diss. Organic Carbon			
TSS			
Hardness			
Alkalinity			
Fish			
Total Hg			
Sediment			
Total Hg			
MeHg			

5.2.7 Duplicate/Replicate Analysis

The best estimate of precision for the overall monitoring program is the comparison of duplicate samples. The variability in the results obtained from duplicate samples is a sum of the sampling and analytical variability, and is the most meaningful measure of uncertainty in the individual samples obtained. Duplicate samples are collected as independent samples using the same sampling procedures. The duplicate set of sub-samples should then be filled after all containers have been filled from the initial sample. The criteria for duplicate field samples are Field replicates +/-50% RPD for samples >5 times the method reporting limit (MRL) or +/- the MRL for the average between replicates when the concentrations are <5 times the MRL.

5.2.8 Matrix Spike Analyses

Matrix spikes are analyzed at the ten-percent level. Criteria for matrix spikes are 75% to 125% recovery. Spike recoveries are used to determine the analytical accuracy of the test method. Every sample observed to exhibit matrix interference is analyzed using “Standard Additions” method. Sample dilution is sometimes used to minimize interference. Some methods require the use of an interference check standard to ensure that interferences are being corrected for.

A prepared matrix “spiked” sample for total mercury has been ordered through a local vender. The sample will be submitted for analysis and identified as a “spike” sample for the appropriate laboratory. The quantity will be provided if requested and required as part of the laboratory QA/QC guidelines. It was decided that a one sample set for a spike analysis would not be

adequate for such a small overall sample size and that an additional duplicate sample set would create more reliable comparison data.

6.0 Study Design

6.1 Fish Tissue Collection

6.1.1 Rationale/Background

Historic fish tissue data showed total mercury concentrations ranged from 0.030 ppm to 2.40 ppm and averaged 0.492 (median 0.345 ppm) total mercury (Hill *et al.* 1973 and CH2M Hill 1994). At present time, it is expected Idaho will adopt EPA recommended criteria of 0.300 mg/kg methyl mercury concentration in fish tissue (EPA 2001). The historic data presented above represents total mercury concentration. Most studies have indicated 85-95% of the mercury in fish tissue is in the form of methyl mercury (Noren and Westoo 1967 ***IN*:** Hill *et al.* 1972; Mason *et al.* 2005) In addition to levels found in Jordan Creek within Idaho, high levels have also been found in the receiving waters in Oregon. Fish consumption advisories have been issued for Antelope Reservoir and lower Jordan Creek. Antelope Reservoir is stocked with water from Jordan Creek, but would not naturally or topographically be within the drainage. Advisories have also been issued for the Owyhee River and Owyhee Reservoir. Both water bodies receive inflows from Jordan Creek (Koerber 1995). Another reservoir, Cow Lakes, has data indicating that fish tissue mercury levels exceed the 0.350 ppm limit set by the state of Oregon Department of Human Services. Total mercury levels in Cow Lakes Reservoir ranged from 1.250 to 1.510 ppm (IN: Hill *et al.* 1973). Later evaluations of Cow Lakes Reservoir in 1980's by the state of Oregon indicated mercury levels were not exceeded (EPA Communication 2005) No advisory has been issued. It should be noted that Jordan Creek does not provide waters to this reservoir, which receives runoff from Cow Creek and Mahogany Creek, the primary watersheds for Cow Lakes Reservoir

Considering the dates that fish tissue was collected in Idaho's portion of the Jordan Creek watershed, more updated information is required. This in addition to the changing from a water column criteria for mercury to the fish tissue criteria.

6.1.2 Stations/Locations

Eight stations have been selected for collection of fish tissue and total mercury analysis. Table 4 shows the location for fish tissue collection. Due to budget restraints, fish tissue collections sites are less than the total number of stations that will receive sediment and water sampling.

Table 4 Fish Tissue Collection Sites. Jordan Creek Watershed.

Site Number	Site Id	Site Description	DMS -LAT	DMS-LONG	Comments
1	JC-2005-01	Jordan Creek at Stateline	42.9537	-117.0253	Lowest section in Idaho
2	JC-2005-02	Jordan Creek Upstream upstream of Williams Creek	42.873	-116.8882	Low Gradient Section before Diversions
3	FC-2005-05	Flint Creek Upstream of Jordan Creek	42.8861	-116.8627	Intensive Mining and Milling, Small Watershed
4	FC-2005-06	East Creek Upstream of Flint Creek	42.8975	-116.7839	Flint Cr. Watershed, No Mining in Headwaters
5	LC-2005-07	Louse Creek Upstream of Jordan Creek	42.9358	-116.8673	Low Intensive Mining, South of Delamar Mine
6	JC-2005-08	Jordan Creek Below Placier Tailings	42.9677	-116.8937	Below Placier Workings and Mercury Mine
7	JC-2005-09	Jordan Below Delamar Mine at Road Crossing	43.0213	-116.8639	Below Delamar and Historic Hard Rock Mines
8	JC-2005-011	Jordan Creek Below Silver City	43.0225	-116.7349	Confluence of Many Hard Rock Mines

6.1.3 Sampling Dates

Fish tissue collection will occur over a four day period in the summer of 2005, June 27th through June 30th. Dates are shown in Table 2. With low snow accumulation during the recent winter it is not anticipated that adequate flows will occur after mid-July.

6.1.4 Target Species/Groups

Trophic level, length, weight, and age of the fish can affect mercury concentrations in fish and can be confounding variables for understanding the bioaccumulation of mercury.
Mercury concentrations in fish collected in 1970's focused on salmonid species in the upper portion of the watershed and Antelope Reservoir as indicators of mercury levels. Additional species analyzed included dace, sculpin, suckers, Northern pike minnow and shiners. The use of multiple species, from distinct trophic levels, is advantageous for describing the bioaccumulation of mercury because a more complete range of conditions and receptor organisms can be considered. Certain indicator species and/or community structure have been identified as desirable targets for analysis in the Jordan Creek watershed. These targets are:

Target Group 1.Game Species (trout, bass) in adequate size to be deemed as a desirable-catachable and edible fish.
Target Group 2.Bottom dwellers (bottom feeders), such as suckers and/or carp.
Target Group 3.Intergravel dwellers such as sculpin.
Target Group 4. Young of year trout species.

Tissue analysis of game species will provide specific data to address current mercury levels to the EPA criteria (EPA 2001) and provide an appropriate link to fish tissue levels and human health risks (i.e. kg of fish consumption/human body weight). Game fish also represent predator species and will be representative of mercury bioaccumulation through the food chain.

Although not usually a desirable/catachable and edible fish species, bottom dwellers such as suckers and carp may be considered desirable species in some cultures. Bottom dwellers feed primarily off vegetation growth on the substrate and have been shown to have the ability to accumulate high concentrations contaminates in their tissue (EPA 2000). This may be associated with their close contact with areas with high methylation and long term exposure. Hill *et al.* (1972) also showed in the lower segments of Jordan Creek, suckers accounted for some of the highest mercury levels detected in the watershed.

Intergravel dwellers such as sculpin have been identified as a possible indicator species due to their ability to sink and live in rubble-gravel substrate because of a water bladder which makes them heavier than water. Their primary feeding area is also associated with this habitat; they feed on eggs, macroinvertebrates, and small fish. As with trout species, they are representative of mercury bioaccumulation through the food chain along with possible exposure from areas of methylation.

Young of the year salmonids (YOY), trout, are good indicator of short term changes in the food chain (Mason et al. 2005). Their home range remains limited during their rearing period, and their primary food source is bottom dwelling macroinvertebrates. Mercury levels found in YOY will be representative of recent exposure, including the incubation and fry development phase.

6.1.5 Required Number of Fish per Target Species

Edible flesh samples from composite adult fish will be analyzed for total mercury and used to determine tissue levels compared to the tissue criteria. Whole body analysis will be used on smaller species (YOY trout and sculpin) for source assessment.

Fish lengths and weights will be recorded at the time of collection. Samples from each location for each target species or group will be collected if possible. In accordance with EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA 2000) the number of fish required or the number of samples to receive analysis is determined with the use of screening values (SV). The use of the SV of 0.3 ppm and not the recommended SV of 0.6 ppm is based on the fact that previous studies have shown this 0.6 ppm value is exceeded at numerous locations in the watershed. The SV value of 0.3 ppm is utilized as a statistical tool to determine the appropriate number of fish required for a representative sample size, and to reduce the impact to the fish population (taking) at a given site.

The following hypotheses are established to determine the appropriate number of fish required and an appropriate number of samples to be submitted to be representative of the sites. The hypotheses are:

H_0: fish tissue Hg $\leq$ SV=0.3 ppm (Idaho)
H_A: fish tissue Hg > SV=0.3 ppm (Idaho)

Table 5 shows the historic fish tissue data. Table 6 shows the sample size requirements for each site and fish category to reach the USEPA desired 70-80% power for hypothesis testing. Table 6 also lists the sample size requirement based on precision of the measurement only.

As an example, for Jordan Creek near the Stateline and fish group 2 (suckers and carp), it is observed 7 fish showed minimum tissue mercury concentration of 0.60 ppm and mean concentration of 0.82 ppm. It is very likely the fish in this group will exceed the SV of 0.3 ppm. Therefore, instead of 46-58 fishes required to meet the precision (0.06 ppm), only 3 fishes are necessary to test the hypothesis, that is, is the fish tissue mercury level greater than the SV at the desired power of 70-80%. The sample size and power analysis is also illustrated in Figure 2 and Figure 3 for Flint Creek and Jordan Creek above Williams Creek. The y-axis is the power and x-axis is the sample size. X-axis reference line indicates the sample size of current data and y-axis reference line (0.7 and 0.8) indicates the desired power by EPA.

Table 7 shows the variability reduction by composite samples using same number of individual fish. Ten individual fish are simulated by random sampling (random generation and random normal generation). The variations for the 10 individual fish are 0.28 for both random generation mechanisms. The 10 fish are randomly chosen to make 3 composite samples. The results showed that composite samples reduced the measurement variability by half. The standard deviation is 0.15 and 0.14 for random generation and random normal generation respectively. Therefore, if the total numbers of fish are decided for each fish category of each site, composite samples are more desirable to enable precise and powerful estimation.

In conclusion, at least 3 composite samples are recommended. If 10 fish are collected, then 3 composite samples (i.e., 2 composite samples made of 3 individual fishes each and the third composite sample contains the remaining 4 fish) are recommended rather than measuring 10 individual samples.

YOY trout species and sculpins will be composite samples of an adequate number to meet the required sample weight for analysis, approximately 200 grams for each group. It will be attempted to collect a total of 500 grams per group, but protection of the fishery community structure and population must be considered and may limit the ability to collect the extra 300 grams. Composite samples should contain species of similar size. Although whole body composite is not an ideal sampling media for gathering fish tissue data, it may be an appropriate sampling effort to identify sources in the watershed.

Table 5. Historic Fish Tissue Data. Jordan Creek Watershed.

Sites from Hill et al. (1973)	Fish Group[1]	Number of Fish (n)	Mean Hg (ppm)	Median Hg (ppm)	Min Hg (ppm)	Max Hg (ppm)	Standard. Deviation (ppm)
Flint Creek	1	14	0.19	0.12	0.10	1.01	0.24
Flint Creek	2	6	0.22	0.23	0.12	0.28	0.06
Flint Creek	3	5	0.72	0.74	0.13	1.03	0.35
Jordan Creek nr Stateline	0	6	0.73	0.74	0.47	0.96	0.19
Jordan Creek nr Stateline	1	1	1.06	1.06	1.06	1.06	N/A
Jordan Creek nr Stateline	2	7	0.82	0.77	0.60	1.02	0.16
Jordan Creek ab Silver City	1	5	0.37	0.26	0.22	0.86	0.28
Jordan Creek ab. Williams Cr.	0	7	0.75	0.72	0.39	1.03	0.23
Jordan Creek ab. Williams Cr.	1	2	0.56	0.56	0.23	0.88	0.46
Jordan Creek ab. Williams Cr.	2	11	0.73	0.73	0.44	1.09	0.20
Jordan Creek ab. Williams Cr.	3	2	0.46	0.46	0.28	0.64	0.25
Jordan Creek bl Silver City	0	12	0.63	0.64	0.34	1.05	0.24
Jordan Creek bl Silver City	1	15	0.51	0.22	0.13	2.40	0.69
Jordan Creek bl Silver City	2	9	0.75	0.72	0.43	0.93	0.16
Jordan Creek ab Silver City	1	12	0.20	0.21	0.05	0.30	0.08

[1] O Group is based on non-determination of individual species at that site

Table 6. Sample Size Calculation and Power Analysis, Historic Fish Tissue Data. Jordan Creek Watershed.

Sites from Hill *et al*. (1973)	Fish Group[1]	CV (%)	Power (%)	Sample Size for Power (70-80%)	Sample Size for 20% SV (precision)
Flint Creek	1	122.67	49	24-31	101-128
Flint Creek	2	27.66	87	5-6	9-10
Flint Creek	3	49.48			
Jordan Creek nr Stateline	0	26.29			
Jordan Creek nr Stateline	1	N/A	N/A		
Jordan Creek nr Stateline	2	19.00	99	3	46-58
Jordan Creek ab Silver City	1	74.95	12	77-101	137-173
Jordan Creek ab. Williams Cr.	0	31.02			
Jordan Creek ab. Williams Cr.	1	82.81	12	17-21	365-464
Jordan Creek ab. Williams Cr.	2	27.35	99	3-4	71-90
Jordan Creek ab. Williams Cr.	3	55.34			
Jordan Creek bl Silver City	0	38.67			
Jordan Creek bl Silver City	1	135.36	30	53-69	819-1040
Jordan Creek bl Silver City	2	21.29	99	3	46-58
Jordan Creek ab Silver City	1	41.53	99	5-6	14-16

[1] O Group is based on non-determination of individual species at that site

Table 7. Compare the variability of individual 10 samples with 3 composite with 3,3,4 individual fish for each composite sample. Jordan Creek Watershed

ID	Sample ID	n (random)	n (normal)	random grouping	Composite (random)	Composite (normal)
Composite	1	0.84	0.52	8		
# 1	2	0.9	0.06	3		
	3	0.26	0.51	1	0.44	0.44
Composite	4	0.99	0.17	7		
# 2	5	0.56	0.38	5		
	6	0.45	0.11	4	0.75	0.19
Composite	7	0.69	0.02	10		
# 3	8	0.22	0.28	2		
	9	0.32	0.39	6		
	10	0.78	0.28	9	0.61	0.21
Mean=		0.6	0.27		0.6	0.28
Standard Deviation =		0.28	0.28		0.15	0.14
Mean =		0.29				
Standard Deviation =		0.24				
Minimum =		0.10				
Maximum =		1.01				

Note: random=random number generated from 0.10 to 1.01 ppm Hg
normal=random number generated from normal distribution with
mean=0.29 and standard deviation (stdev)=0.24

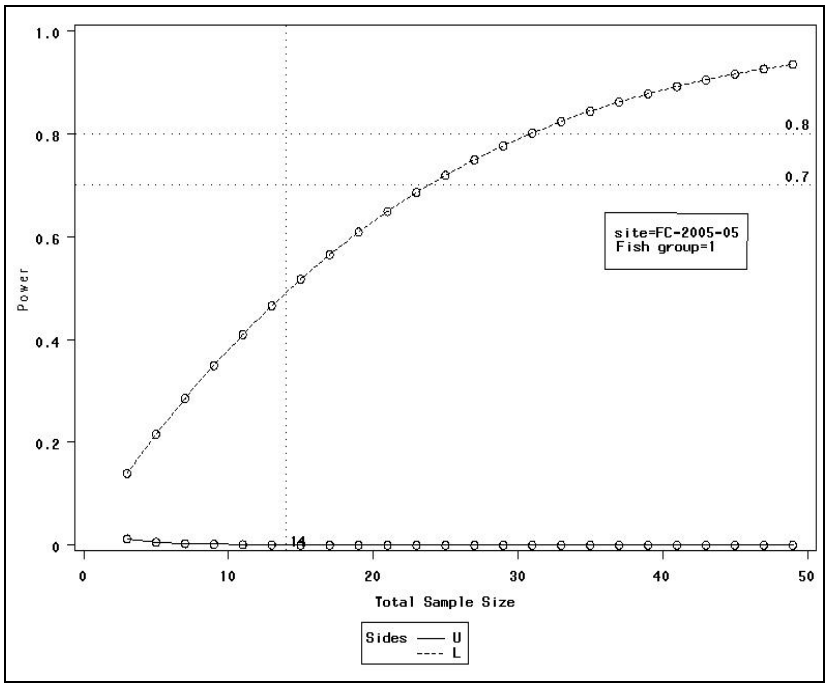

Figure 2. Power Analysis Flint Creek. Jordan Creek Watershed.

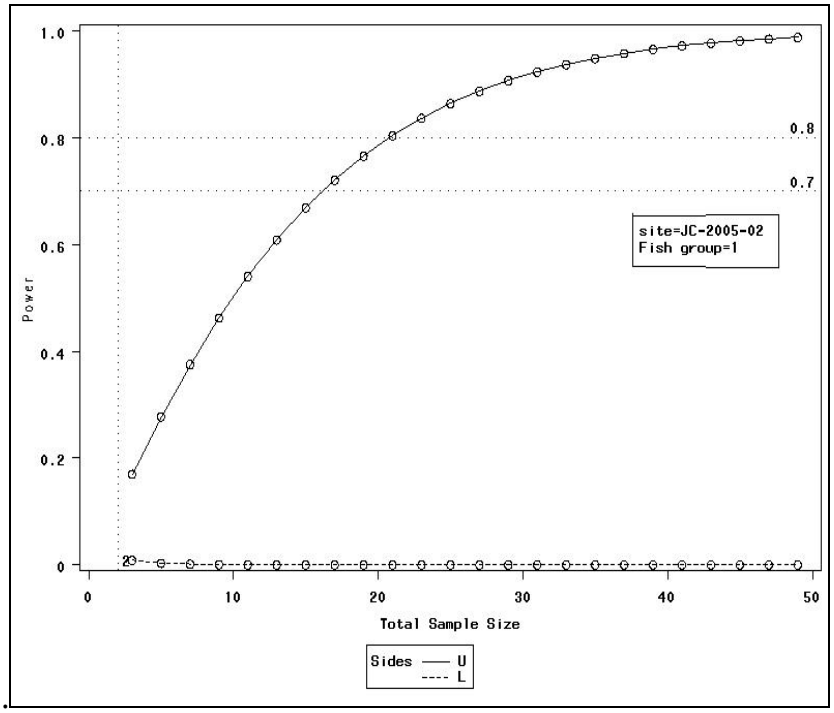

Figure 3. Power Analysis Jordan Creek above Williams Creek. Jordan Creek Watershed.

6.2 Water Chemistry Samples

6.2.1 Background/Rationale

With all the information on the way mercury acts-reacts to the biological, chemical and physical condition in an aquatic environment, if mercury is detected in the water column it would probably be in close proximity to the primary source, elemental mercury, or the source of methylation and ionic forms of mercury. Any transport of mercury in elemental form would be associated with high flow periods and/or the movement of bedload material. Transport of ionic mercury would be associated with suspended sediments or organic material (i.e. organic carbon) which could occur at anytime.

Water samples will be analyzed for both total mercury and dissolved mercury. Samples will be collected once during the Tier I monitoring effort and as close to fish tissue collection times as possible. As discussed in Section 1.4, issues arose in the contractual agreement with a private lab to conduct sediment and methyl mercury analysis. As to date, water and sediment sampling will occur thirty plus days after fish collection.

6.2.2 Station Location

The number of water chemistry collection sites will remain from the first sites proposed, with a total a number of eleven sites. Table 8 provides information on the selected sites.

6.2.3 Sampling Dates

Water sample collection will occur once in the summer of 2005, preferably prior to July 1st, Table 2 shows dates that have been selected for surface-sediment sample collection. With low snow accumulation during the recent winter, it is not anticipated that adequate flows will occur after mid-July. As discussed in Section 1.4, issues arose in the contractual agreement with a private lab to conduct sediment and methyl mercury analysis. As to date, water and sediment sampling will occur thirty-plus days after fish collection.

6.2.4 Water Chemistry Analyses

Ambient water chemistry samples will be collected at the sites shown in Table 8. The primary analysis will be for total mercury, dissolved mercury and methyl mercury. In addition to mercury analysis, additional samples will be collected and will require laboratory involvement. The additional parameters include total organic carbon, dissolved carbon, hardness, alkalinity and total suspended solids (TSS). Water chemistry/physical parameters will be taken at each site and include dissolved oxygen (DO), pH, oxygen reduction potential (redox), water temperature and conductivity. Parameters for water analysis are located in Tables 10 and 11.

Total numbers of samples collected and requiring laboratory support are located in Table 14. The final numbers of samples also represent field blanks, duplicate and spiked QA/QC samples incorporated into the overall design.

Table 8. Water Chemistry Collection Sites. Jordan Creek Watershed

Site Number	Site Identification	Tier Type Monitoring	Site Description	DMS -LAT	DMS-LONG	Comments
1	JC-2005-01	I	Jordan Creek at Stateline	42.9537	-117.0253	Lowest section in Idaho
2	JC-2005-02	I	Jordan Creek Upstream upstream of Williams Creek	42.873	-116.8882	Low Gradient Section before Diversions
3	FC-2005-05	I	Flint Creek Upstream of Jordan Creek	42.8861	-116.8627	Intensive Mining and Milling, Small Watershed
4	FC-2005-06	I	East Creek Upstream of Flint Creek	42.8975	-116.7839	Flint Cr. Watershed, No Mining in Headwaters
5	LC-2005-07	I	Louse Creek Upstream of Jordan Creek	42.9358	-116.8673	Low Intensive Mining, South of Delamar Mine
6	JC-2005-08	I	Jordan Creek Below Placier Tailings	42.9677	-116.8937	Below Placier Workings and Mercury Mine
7	JC-2005-09	I	Jordan Below Delamar Mine at Road Crossing	43.0213	-116.8639	Below Delamar and Historic Hard Rock Mines
8	JC-2005-11	I	Jordan Creek Below Silver City	43.0225	-116.7349	Confluence of Many Hard Rock Mines
9	BC-2003-03	I	Boulder Creek Upstream of Jordan Creek	42.8638	-116.8561	Some Mining Activity Upstream
10	BC-2005-04	I	Rock Creek below Triangle Reservoir	42.8078	-116.6983	No Known Mining in Watershed
10A	BC-2005-04A	I	Alternative to 2005-04	42.8232	-116.7592	No Known Mining in Watershed
11	JC-2005-10	I	Jordan Creek Below Blue Gulch	43.0395	-116.7749	Downstream of Numerous Hard Rock Mines
12	WC-2005-13	I	Williams Creek Upstream of Jordan Creek	42.8426	-116.9359	Watershed from South Mountain Mines

Highlighted Refers to Alternate Station

6.3 Stream Sediments

6.3.1 Background

With available information, mercury in the water column would probably be found in close proximity to either the primary source, elemental mercury, or to the source of methylation and ionic forms of mercury. Any transport of mercury in elemental form would be associated with high flow periods and/or the movement of bedload material. Transport of ionic mercury would be associated with suspended sediments or organic material (i.e. organic carbon) which could occur at any time. Deposition of particle bound ionic mercury will be affected by a variety of conditions, including mercury saturation, buoyancy of particulates, stream velocity and other physical and chemical properties of the ambient water.

Current mercury issues in Antelope Reservoir and other downstream segments may indicate a direct relationship to primary sources and the transport of ionic mercury from the upper segments of the Jordan Creek watershed. As water is diverted to the reservoir, especially during high flow periods, large loads of mercury are diverted to an environment favorable to methylation. Although the potential for methylation is more favorable in lentic situations, methylation has been documented in benthic situations also. Jordan Creek becomes a very low gradient water body (<1%) creating areas of deposition for both inorganic and organic material during low flow periods.

6.3.2 Station Location

With limited funding available, the number of fish tissue collection sites was reduced from the first delineation of possible sites. The number of stream sediment collection sites will remain from the first sites proposed, with a total a number of twelve sites. Table 9 provides information on the selected sites.

6.3.3 Sampling Dates

Sediment collection will occur once in the summer of 2005, preferably around July 1st and will occur at the same time as water chemistry samples are collected. Table 2 shows dates that have been selected for surface-sediment sample collection. Low flows during the summer of 2005 may enhance the ability to locate depositional areas that would normally be submerged. As discussed in Section 1.4, issues arose in the contractual agreement with a private lab to conduct sediment and methyl mercury analysis. As to date, water and sediment sampling will occur 30 plus days after fish collection.

6.3.4 Stream Sediment Analyses

Sediment samples will be collected at the sites shown in Table 9. The primary analysis will be for total mercury and methyl mercury. In addition to the analysis of the sediment for mercury, additional physical and chemical information will be required. In field data will be collected on sediment samples and include pH, dissolved oxygen and redox potential. Tables 10 and 11 presents information for selected sediment parameters for analysis. Tier II monitoring will add additional parameters and include grain size, bulk density and pore water analysis for mercury components.

Table 9. Stream Sediment Collection Sites. Jordan Creek Watershed

Site Number	Site Identification	Tier Type Monitoring	Site Description	DMS-LAT	DMS-LONG	Comments
1	JC-2005-01	I	Jordan Creek at Stateline	42.9537	-117.0253	Lowest section in Idaho
2	JC-2005-02	I	Jordan Creek Upstream upstream of Williams Creek	42.873	-116.8882	Low Gradient Section before Diversions
3	FC-2005-05	I	Flint Creek Upstream of Jordan Creek	42.8861	-116.8627	Intensive Mining and Milling, Small Watershed
4	FC-2005-06	I	East Creek Upstream of Flint Creek	42.8975	-116.7839	Flint Cr. Watershed, No Mining in Headwaters
5	LC-2005-07	I	Louse Creek Upstream of Jordan Creek	42.9358	-116.8673	Low Intensive Mining, South of Delamar Mine
6	JC-2005-08	I	Jordan Creek Below Placier Tailings	42.9677	-116.8937	Below Placier Workings and Mercury Mine
7	JC-2005-09	I	Jordan Below Delamar Mine at Road Crossing	43.0213	-116.8639	Below Delamar and Historic Hard Rock Mines
8	JC-2005-11	I	Jordan Creek Below Silver City	43.0225	-116.7349	Confluence of Many Hard Rock Mines
9	BC-2003-03	I	Boulder Creek Upstream of Jordan Creek	42.8638	-116.8561	Some Mining Activity Upstream
10	BC-2005-04	I	Rock Creek below Triangle Reservoir	42.8078	-116.6983	No Known Mining in Watershed
10A	BC-2005-04A	I	Alternative to 2005-04	42.8232	-116.7592	No Known Mining in Watershed
11	JC-2005-10	I	Jordan Creek Below Blue Gulch	43.0395	-116.7749	Downstream of Numerous Hard Rock Mines
12	WC-2005-13	I	Williams Creek Upstream of Jordan Creek	42.8426	-116.9359	Watershed from South Mountain Mines

7.0 Sampling Procedures/Methods

7.1 Fish Tissue Collection and Assessment Methods

Fish tissue collection, preservation and shipping will follow procedures as described in the Guidance for Assessing Chemical Contamination Data for Fish Advisories (EPA 2000).

7.1.1 Field Collection

Fish collection will be conducted with a 3-4 person crew, one backpack operator, two netters and a bucket person. To satisfy requirements of the fish-collecting permit, electro-fishing effort will be timed. An effort will be made to evaluate a site of approximately 100 meters and with habitat consisting of a riffle section, a glide/run, a pool tail out and a pool. Areas with considerable historic deposition are of primary concern. It is expected that only two-three sites

can be sampled in one day. In total, approximately twenty (20) large fish will be collected at each site and treated as individual samples

Collection should continue until desirable game species (trout and/or bass) are collected that will result in a total of ten (10) fish per site and muscle tissue exceeding 500 grams. For bottom feeders, collection should also continue until desirable species (suckers, carp…etc) are collected that will result in a total of ten (10) fish per site and muscle tissue exceeding 500 grams. In total, approximately twenty (20) large fish will be collected at each site and with three composite sample submitted for analysis . Collection of this number of fish will comply with recommendation in Guidance for Assessing Chemical Contamination Data for Fish Advisories (EPA 2000).

Lengths and weights will be recorded at the time of collection. Samples from each location for each target species or group will be collected from each site. Analysis will be performed on individual fish to best describe the mercury variability. YOY trout species and sculpins will be composite samples of an adequate number to meet the required sample weight for analysis. Composite samples should contain the same species of similar size.

Whole body samples for the YOY trout and sculpin will be used for laboratory analysis. The first composite will consist of young of the year (YOY) trout species. YOY salmonid will be classified as individuals less than 100 mm in length. The number of replicate fish required will be determined through the EPA recommendations. The fourth composite sample will consist of sculpin species. These groups will not be representative of the edible fish population, but utilized as a source assessment indicator.

Fish handling will be conducted using EPA Method 1669, clean-hands dirty-hands protocols (EPA 1996). A single (clean-hands) person wearing latex gloves will be responsible for sorting, measuring, packaging and storing all fish. Fish will be measured for length and identified. The larger fish (trout, bass and bottom dwellers) will be treated as individual samples, bagged in a recloseable bag and wrapped in heavy strength aluminum foil and placed in an ice chest/cooler.

Samples for YOY salmonids and sculpin will be a composite of two separate whole fish samples. The YOY salmonid and sculpin will be measured and two composite whole fish samples made. These composites will be bagged in a recloseable bag and wrapped in heavy strength aluminum foil and placed in an ice chest/cooler for transportation.

7.1.2 Field Documentation

Documentation of species collected will occur immediately after collection. Recloseable bags will be inscribed with pertinent information of the species collected and include the following information:

Station ID JC-2005-11-THg-H2O
EPA Sample Number

Date and Time								Matrix	# of	Pres.
YR	WK	SEQ#	YR	MO	DA	Hr	Min	Code	Samples	Code
05	32	4200	05	08	8	12	00	10	01	T

Field forms can be seen in Appendix B.

7.2 Water Chemistry Collection and Assessment Methods

Water quality sample processing should occur in a clean and stable workplace at or near the sampling site. Ideally, samples should be processed in a clean-controlled environment. However, for the Jordan Creek monitoring effort all samples will be processed outside. Before sampling begins, a work table will be established, and covered in plastic to prevent any outside contamination.

7.2.1 Water Chemistry-Water Sample Collection (Mercury Samples)

Water samples for mercury will be collected as grab samples. Field staff will follow "clean hands" and "dirty hands" collection techniques as per EPA Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. Fluoropolymer or borosilicate glass bottles with fluoropolymer or fluoropolymer-lined caps will be utilized for mercury samples.

Sample bottles for all other collection parameters are outlined in Table 12. Field staff will wear Tyvek coveralls and ultra length PVC powder free gloves to minimize risk of contaminating samples. Sampling sites will exhibit a high degree of cross-sectional homogeneity. Water samples will be collected as far as possible from bridges, wires, poles, and regularly traveled roads. Extreme care will be taken to minimize the exposure of the sample to human, atmospheric, and other sources of contamination. Field staff will avoid sampling water that has been disturbed through wading. Sample bottles will be filled through the use of a peristaltic pump.

Due to the risk of contamination (as stated in EPA method 1669), water samples should be filtered in a clean-controlled environment. Water samples to receive analysis for methyl mercury will not be filtered by DEQ personnel, but filtered at the laboratory selected to conduct the analysis. After consultation with the EPA and Frontier Geosciences laboratories, it was determined the number of samples that would be filtered either by the respected laboratories or by DEQ field personnel that field filtering would occur for all samples. Almost 1 liter of water is required to run the selected parameters, and since filtering was going to occur for non-mercury samples it was determined that samples for mercury analysis should be treated in the same manner.

After collection and proper documentation has been completed, the samples will be placed in a cooler and chilled to 4^{o}C. Samples will be transport back to Boise daily and stored in an assigned secure refrigerator at the DEQ-Boise Regional Office Laboratory. Adding of preservatives to samples will occur once samples are in a clean-controlled environment at the DEQ-Boise Regional Office Laboratory or at the designated laboratory and will be added before storage. Samples will be preserved according to the analytic's specific protocol outlined in Table 12. For water samples, the recommended holding time is 28 days for both total mercury and dissolved mercury. Once all samples have been collected, samples will be

shipped by overnight courier to the EPA laboratory and the laboratory selected for sediment and methyl mercury analysis.

7.2.2 Water Chemistry-Water Sample Collection (non-Mercury Samples)

For non-mercury samples, the peristaltic pump will be used to collect these samples. This will allow for samples collected for dissolved organic carbon (DOC) and hardness to be filtered at the same time as those mercury samples requiring filtering. Table 10 and 11 provides information on the additional water chemistry samples that will be collected in Jordan Creek during the Tier I monitoring event. Collection of non-mercury water samples will follow procedures outlined by Ralston and Browne (1976). Clean-hands techniques (EPA 1996) will not be required for non-mercury sample collection. However, sample collection will occur at the same time, so field personnel will be using "clean hands" techniques.

7.2.3 Water Chemistry-Physical Parameters

In addition to water chemistry samples collected for laboratory analysis, physical characteristics should be documented. These parameters include water temperature, dissolved oxygen, pH, and conductivity. Physical parameters will be collected with (as an example) a Yellow Springs Instrument (YSI) Model 556 handheld multiprobe system. Field parameters for physical water quality characteristics are located in Table 11. Field forms can be seen in Appendix B.

7.3 Stream Sediment Collection

Streambed sediment processing should occur in a clean and stable workplace at or near the sampling site. Ideally, samples should be processed in a clean-controlled environment. However, for the Jordan Creek monitoring effort all samples will be processed outside. Before sampling begins, a work table will be established, and covered in plastic to prevent any outside contamination.

All sediment sampling will follow procedures outlined in EPA's Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. Field personnel will sample sediments from stream depositional areas using a sterile PVC scoops to remove sediment from stream substrate. Equipment will be washed with Liquinox before the collection of each sample and sterile scoops will be used only once as they are disposable.

7.3.1 Collection Methods

Field staff will be wearing Tyvek suits and opera length PVC powder free gloves. Field staff will establish a clean plastic bag lined cooler to store the polycarbonate container for temporary subsample sediment storage. Five sub samples will be collected to represent each site. Each subsample will be collected from an area of 5cm by 5cm. The top 2 cm of each subsample will be removed with a sterile scoop and placed into a closable polycarbonate container. The polycarbonate container will reside in a clean plastic bag lined cooler with ice to keep the sample chilled. The "clean hands" field staff member will be the only person in contact with the sample scoop and baggie. The total target sample volume of the five sub-samples should be about 800 ml.

Processing sub samples will be homogenized and composted in the baggie by stirring for about 45 seconds with a sterile spoon. The sediment sample will be stirred, avoiding forcing excessive air into the sample. Field staff will first remove enough of the composite sediment sample with a sterile spoon to fill a 4 oz bottle for methyl mercury analysis. Methyl mercury sediment samples will be immediately placed on dry ice in a dark cooler. Additional samples from the composite will be taken for total mercury and total solid measurements.

To collect pH and redox data on sediment samples field crews will take redox measurements using an electrometric probe directly from the top 2cm of the composite sediment sample. Sample measurements will be made immediately after composite sample is pulled. Redox/pH measurement will be taken directly from the baggie immediately after the sample is taken.

7.3.2 Sediment Analysis

Stream sediment analysis will be conducted for total mercury and methyl mercury. Additional analysis for pore water extracted from sediments will be conducted in the Tier II portion of the study. Redox and pH measurements will be conducted in the field with the use of a multiprobe instrument (as an example a Yellow Springs Instrument (YSI) Model 556 handheld multiprobe system). Field parameters for physical sediment characteristics are located in Tables 10 and 11.

Table 10. Selected Chemistry Analysis. Jordan Creek Watershed.

Site Identification	Sample Matrix	Sampling Schedule	Hg (Total)	Hg (Diss.)	MeHg	TSS	Hardness	TOC[1]	Alkalinity	Diss. Organic Carbon
JC-2005-01	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005[4]	EPA	EPA	FGS[2]	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
JC-2005-02	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
FC-2005-05	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
FC-2005-06	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
LC-2005-07	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
JC-2005-08	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
JC-2005-09	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
JC-2005-011	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
BC-2005-03	Water/ Sediment	June-22-23, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
BC-2005-04[3]	Water/ Sediment	June-22-23, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
BC-2005-04A	Water/ Sediment	June-22-23, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
JC-2005-010	Water/ Sediment	June-22-23, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab
WC-2005-013	Water/ Sediment	June-22-23, 2005	EPA	EPA	FGS	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab	Idaho Lab

1 Total Organic Carbon 2 Frontier GeoSciences, Inc. 3 Highlighted Refers to Alternate Station 4 Scheduled Fish Tissue Collection Dates

Table 11. Selected Field Analysis. Jordan Creek Watershed.

Site Identification	Sample Matrix	Sampling Schedule	pH	ReDox	DO	Temperature
JC-2005-01	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005[4]	Field	Field	Field	Field
JC-2005-02	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
FC-2005-05	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
FC-2005-06	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
LC-2005-07	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
JC-2005-08	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
JC-2005-09	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
JC-2005-011	Water/ Sediment/Tissue	June-22-23, 2005 June 27-30, 2005	Field	Field	Field	Field
BC-2005-03	Water/ Sediment	June-22-23, 2005	Field	Field	Field	Field
BC-2005-04[3]	Water/ Sediment	June-22-23, 2005	Field	Field	Field	Field
BC-2005-04A	Water/ Sediment	June-22-23, 2005	Field	Field	Field	Field
JC-2005-010	Water/ Sediment	June-22-23, 2005	Field	Field	Field	Field

Highlighted Refers to Alternate Station 4 Scheduled Fish Tissue Collection Dates

8.0 Sample Handling, Transportation and Storage

8.1 Chain of Custody Documentation/Sample Receipt and Log-in Procedures

Separate field data sheets will be maintained for each sampling event. Samples must be accompanied by a form with the following information:

sampling location,
Lat/long,
Date sampled,
time sampled,
sampler,
weather condition,
fund code,
purpose,
data report
recipient,
sampling point description,
container number,
equipment ID numbers,
test(s) requested,
contacts

The Laboratory Sample Tracker (Laboratory QA Manager) verifies the information contained on the Request for analysis form and checks to make certain that samples meet appropriate handling and preservation requirements by:

1. Matching actual sample container #'s with those listed on Request for Analysis form;
2. Checking that appropriate containers were used for the analysis requested;
3. Testing pH to determine whether samples requiring acid or base preservation were preserved correctly;
4. Consult with laboratory analysts to ensure tests requested are appropriate for resolving the field person's concern;
5. Consult QA Project Plan for on-going projects to ensure that all tests requested are assigned.

Samples improperly documented, preserved, or exceeding holding time are either rejected by the Sample Tracker for analysis, or analyzed and the result reported as an "estimate." The sampler is notified and re-sampling is recommended.

8.2 Field Storage and Preparation

All samples will be held in 40-60 quart ice chests/coolers in the field at an approximate temperature of 4 degrees Celsius for a maximum of 24 hours. Each sampling station will have independent ice chests/coolers. Fish samples will be transported back to Boise, ID the day of collection. Additional ice will be applied, if required and the ice chests/coolers secured at the Boise Regional Office laboratory for the night.

Fish samples will be processed within 24-30 hours. Samples will be processed in a clean-controlled environment at the Boise Regional Office lab located at 1445 North Orchard, Boise, ID. A three person crew will be utilized (contracted with DEQ's Technical Services) and will follow clean hands-dirty hand techniques described in EPA Method 1669. One individual will oversee, track and document all procedures during filleting, grinding, packaging, and preparation for shipping. Appendix B contains laboratory procedures and forms.

All fish samples will be processed at the DEQ Laboratory. Staff will prepare a clean and stable workplace to fillet and grind fish samples. Sample preparation will follow procedures described in the EPA's Guidance for Assessing Chemical Contamination Data for Fish Advisories (EPA 2000). Fish will be filleted with ceramic knives. Fish processing personnel will wear Tyvek® suits and booties, and powder free PVC disposable gloves when handling fish. Ground fish samples will be sent to the USEPA laboratory for total mercury and total solids analysis

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Field notes will be documented by a designated scriber. Field documentation will include information concerning individual species identification, length, weight and any notable abnormalities. Additional information concerning site will be documented. Once documentation is complete and all samples are secured, the scriber and field operation coordinator will inventory field notes and store in field notebook.

8.2.1 Sample Preservation

Sample preservatives will be required for some samples. Sample preservation will be carried out at the analytical laboratory.

9.0 Analytical Method Requirements

Quality control criteria and laboratory analysis will be measured using the protocols described in Tables 12 and 13. Table 14 shows the total number of samples to be analyzed for each parameter.

Table 12. Specific for Methods, Sampling Container, Preservatives and QA. Jordan Creek Watershed.

Parameter	Matrix	Method	Bottle	Preservative	Holding Times
Total Hg	Water	USEPA 1631EM	250ml	1 ml H2SO4	90 Days
Dissolved Hg	Water	USEPA 1631EM	250ml	1 ml H2SO4	90 Days
Total Hg	Fish	USEPA 245.6M	Glass	Chill to 4°C	89 days
Total Hg	Sediment	USEPA 245.6	2 oz Glass	Chill to 4°C	89 days
MeHg	Water	TBD[1]	250ml	1 ml H2SO4	TBD
MeHg	Sediments	TBD	2 oz Glass	TBD	TBD
TSS	Water	Standard Methods	1 quart	Chill to 4°C	7 days
Hardness	Water	Standard Methods	1 quart	H2SO4	180 days
TOC	Sediments	Standard Methods	1 quart	1 ml HCL	28 days
Diss. Organic Carbon	Water	Standard Methods	1 quart	1 ml HCL	28 days
Alkalinity	Water	Standard Methods	1 quart	Chill to 4°C	14 days
Temperature	Water	Field	Field	NA	NA
pH	Water	Field	Field	NA	NA
pH	Sediment	Field	Field	NA	NA
Dissolved Oxygen	Water	Field	Field	NA	NA
Redox	Sediment	Field	Field	NA	NA
Conductivity	Water	Field	Field	NA	NA
Grain Size	Sediment	Standard Methods	500ml	Chill to 4°C	180 days

[1] To Be Determined [2] Standard Deviation

Table 13. Reporting Limit,s Detection Limit and QA/QC Controls,. Jordan Creek Watershed.

Parameter	Matrix	Detection Limit	Reporting Limit	Precision	Accuracy	Measurement Range
Total Hg	Water	0.057 ng/l	0.5ng/l	+/- 20%RPD	75-125%	0.2ng/l to 100%
Dissolved Hg	Water	0.057 ng/l	0.5ng/l	+/- 20%RPD	75-125%	0.2ng/l to 100%
Total Hg	Fish	0.0085mg/kg wet weight	0.0125mg/kg wet weight	+/- 20%RPD	75-125%	0.0125mg/kg wet weight
Total Hg	Sediment	0.0085mg/kg wet weight	0.05mg/kg wet weight	+/- 20%RPD	75-125%	0.0125mg/kg wet weight
MeHg	Water	TBD	TBD	TBD	TBD	TBD
MeHg	Sediments	TBD	TBD	TBD	TBD	TBD
TSS	Water	1mg/l	2mg/l	+/- 6.0 mg/l		
Hardness	Water	0.5mg/l	5mg/l			
TOC	Sediments					
Diss. Organic Carbon	Water					
Alkalinity	Water					
Temperature	Water	0.01^{o}C	0.1^{o}C	+/- 0.1^{o}C	+/- 0.5^{o}C	
pH	Water	0.01 su	0.1 su	+/- 0.2 su	+/- 0.3 su	
pH	Sediment	0.01 su	0.1 su	+/- 0.2 su	+/- 0.3 su	
Diss. Oxygen	Water	0.01 mg/l	0.1 mg/l	+/- 0.5mg/l	+/- 0.1mg/l	
Redox	Sediment	0.01mv	1mv	+/- 20mv	+/- 10mv	
Conductivity	Water	0.1umhos/cm	1umhos/cm	+/- 2% STDV[2]	+/- 7%STDV	
Grain Size	Sediment	63microns	63micron	+/-20%RPD	75-125%	>2mm to 63mm

[1] To Be Determined [2] Standard Deviation

Table 14. Individual Large Fish Composite Sample, Laboratory Support, Analytical Methods and Number of Samples Each Matrix. Jordan Creek Watershed

Media/ Parameter	Lab Support Required	Total Number of Samples per Station	Number of Stations	Duplicate Samples	Spiked	Blanks	Total Number of Samples
Water Chemistry							
Total Hg	Yes	1	12	2		4	18
Dissolved Hg	Yes	1	12	2		4	16
Me Hg	Yes	1	12	2		2	16
Total Organic Carbon	Yes	1	12	2		2	16
Dissolved Organic Carbon	Yes	1	12	2		2	16
TSS	Yes	1	12	2		2	16
Hardness	Yes	1	12	2		2	16
Alkalinity	Yes	1	12	2		2	16
pH	No	1	12				
Dissolved Oxygen	No	1	12				
Conductivity	No	1	12				
Fish Tissue							
Total Hg	Yes	8[1]	8	1			72
Sediments							
Total Hg	Yes	1	12	2			14
Me Hg	Yes	1	12	2			14
Redox	No	1	12				
pH	No	1	12				

1 Individual fish fillets for large game and bottom dweller species, 70-80 gram plug taken from each fillets, individual plugs from target species ground.

10.0 Quality Control

All routine quality control procedures will be followed according to DEQ and USEPA QA/QC guidelines. Duplicate quality assurance (QA) samples will be taken at a minimum of 10% of the total number of monitoring sites. A field or equipment blank will also be submitted and analyzed for total mercury in sediment and water. Field blank measurements of temperature, pH, alkalinity and specific conductance will also be taken on site. Any data or sample values outside of the expected range for the parameter being measured will be rechecked for validity in the field by the field team, and if necessary, the field team will resample. Data that continue to be outside expected values will be further investigated to determine the cause, using alternate methodology, if available.

10.1 Field Notebook/Documentation

A bound field notebook will be maintained by the sampling team to provide a daily record of significant events, observations, and measurements during field investigations. This record would include water level data, field measurements, personnel, weather observations, including temperature, cloud cover and physical conditions should they exist such as plankton abundance

and conditions of riparian zones. All entries in the field notebooks should be signed and dated. The field notebooks will be kept as a permanent record.

10.2 Corrections to Documentation

All original data recorded in field notebooks and other forms will be written in waterproof ink. None of these documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on a document assigned to one individual, that individual will make corrections by crossing a single line through the error, entering the correct information, and initialing the correction.

10.3 Laboratory Documentation

Laboratory documentation will track all samples throughout the tracking and processing procedures. Samples will be logged in one station (site) at a time. Samples will be sorted based on target species and compared to the field data information submitted with each station. Chain of custody reporting will be initialed as the first login procedure. An independent laboratory check list will document fish species per target group, number of individuals per target group, assure that each composite abide by same species similar length guidelines and that all samples have been stored in a manner that will not compromise sample integrity (i.e. temperature exceed 4^{o}C, unsealed bags….etc.). Laboratory tracking and processing check list is located in Appendix B.

One DEQ laboratory personnel will be assigned the duty of QA/QC coordinator with the responsibility of over seeing all aspects of tracking samples, documenting the processing of samples and storage.

11.0 Instrument/Equipment Testing, Inspection and Maintained

11.1 Field Instruments/Equipment Testing, Inspection and Maintenance

Instruments for field parameter measurements will follow DEQ's protocol and manufacture's recommendations for testing, inspection and maintenance. Separate logbooks are maintained for each field meter. Field equipment used for obtaining samples will be decontaminated as required and stored in a secure and clean location.

11.2 Laboratory Instruments/Equipment Testing, Inspection and Maintenance

Laboratory instruments/equipment will comply with individuals' laboratory QA/QC procedures for testing, inspection and maintenance. Proper documentation will be provided to the Project Manager if requested.

11.3 Field Decontamination

Decontamination of equipment (gloves, scales, rulers, nets…etc.) will consist of triple rinse in ambient water before and after handling. If overnight storage is required, equipment will be decontaminated with Liquinox, tripled rinsed and stored in new recloseable baggies if applicable. Before the next sampling effort, all equipment will be tripled rinse with ambient water from the first site.

12.0 Instrument/Equipment Calibration and Frequency

12.1 Field Instruments/Equipment Calibration and Frequency

Instruments for field parameter measurements will follow DEQ's protocol and manufacture's recommendations for calibration. Calibration will be conducted at the beginning of each days sampling. Separate logbooks are maintained for each field meter.

12.2 Laboratory Instrument/Equipment Calibration

Instruments/equipment will be calibrated in accordance with individuals' laboratory QA/QC procedures for calibration of instruments and equipment. Proper documentation will be provided to the Project Manager if requested.

13.0 Inspection/Acceptance of Supplies and Consumables

Any equipment, containers, sampling devices, supplies and/or personnel used during the execution of the Jordan Creek study will be obtained at least two weeks prior to the beginning of the in field activity and DEQ Laboratory processing of samples. Names of personnel and duties assigned will be documented. Disposable supplies (i.e. recloseable bags, scopes…etc.) will be purchased, inventoried and stored in containers earmark for the Jordan Creek sampling event and sample processing. Proper transportation for field crews will be obtained two weeks prior to sampling. If appropriate, local lodging will be secured for field crews.

14.0 Non-Direct Measurements

Not Applicable

15.0 Data Management

15.1 Raw Data/Laboratory/Field Results Review

Data will be entered into an Excel® Spreadsheet as soon as possible when received from appropriate laboratory and/or field sampling event. Any discrepancy from any data results will be examined. Once the data has been entered in the project database, the Data Manager will print a paper copy of the data and proofread it against the original field data sheets. Errors in data entry will corrected at that time. Outliers and inconsistencies will be flagged for further review or be discarded. Data quality problems will be discussed as they occur and in the final report to data users. The Project Manager, Quality Director will review all data resulting from this project to determine if it meets the QA Plan objectives. Decisions to accept, qualify or reject data will be made by the Project and Quality Director.

15.2 Data Entry and Storage (to be completed later)

15.3 Reports

A final monitoring report will be prepared and will contain the raw data, a summary of the results, data analysis, and evaluation. Maps with sampling locations and results and a tabular summary of the data will be included with this report. The report will help with decision making about future actions to address the findings.

15.4 Reconciliation with Data Quality Objectives

As soon as possible after each sampling event, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the project's specifications, data may be discarded and resampling may occur. The cause of the failure will be evaluated.

16.0 Assessment and Response Actions

Corrective action is initiated whenever an "out of control" condition is identified (e.g. either control limits or holding time has been exceeded). The analyst is responsible for initiating corrective action, which generally consists of:

Analytical system recalibrated or verified and analysis repeated, if holding time permits.

Documentation of "out of control" condition, corrective action taken, and the results documented on an Incident Report Form, which is given to the Project Manager, Quality Director and Line Manager. They investigate the "out of control" condition, along with the analyst, and decide on a course of corrective action. If time for reanalysis exceeds the allowable holding time for the analyte, the following procedure is followed:

Sampler is notified and resampling is requested, or If resampling is not feasible, and the particular analytical results are not critical, initial analytical results are flagged and reported as an "estimate", indicating all QC criteria have not been met. Data identified as violating the data quality objective criteria will be reviewed by the appropriate Laboratory Manager (organic or inorganic), and the Project Manager and a decision will be made on the suitability and use of the data. Situations requiring corrective action for sample collection will be dealt with immediately, such as equipment malfunction. Sample collection events requiring corrective action that can not occur immediately will be considered a long-term corrective action. The corrective actions will be detailed in the field sampling notebook by the Field Line Manager and reviewed by the Project Manager.

For any analytical data set, data qualifiers are assigned to each sample and chemical estimate by the analytical laboratory. Sample data can be qualified for many different reasons, including poor surrogate recovery, blank contamination, or calibration problems. Several qualifiers may be given. In general these are:

R – Notes that an aspect of the analysis (such as spike recovery) was not within control limits as specified by the sample protocol, therefore, it is recommended that results be rejected from use.

J – Notes the compound is present but the concentration value is estimated.

B – For organic data sets, notes the chemical was also detected in the associated analytical lab blank, and thus, the concentrations may reflect some degree of laboratory contamination.

U – Notes the analyte was not present at a concentration able to be identified.

Data flagged with an R are typically discarded from the data set prior to analyses. The J flagged data will be assumed as actual concentrations and used for subsequent analyses based on the values reported. Any other data qualifier that is not complete understood will be discussed with the reporting agency and the Project Manager.

17.0 Reports to Management

The final SBA for the Jordan Creek Watershed will serve as the final documentation of all aspects of the mercury evaluation of fish tissue in the Jordan Creek watershed. If management request periodic updates, they will be provided within an allotted timeframe. If required by IDHW for a fish consumption advisory, a data presentation and findings will be developed prior to the final SBA.

18.0 Data Review, Validation, and Verification

18.1 Data Verification

Data verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Data verification will be the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method or procedural.

For field collected data, once the data has been entered in the project database, the Project Manager will print a paper copy of the data and proofread it against the original field data sheets. Errors in data entry will corrected at that time. Discrepancies in field information/data will be discussed with the Line Manager. Outliers and inconsistencies will be flagged for further review or be discarded. Data quality problems will be discussed as they occur and in the final report to data users.

18.2 Data Validation

Data Validation is confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. The Project Manager and the Line Managers will review all data resulting from this project to determine if it meets the QAPP objectives. Decisions to accept, qualify or reject data will be made by the Project Manager and the Quality Director.

19.0 Verification and Validation Methods

Data verification and validation may be performed by personnel involved with the collection of samples, data entry, generation of analytical data, and/or by an external data verifier. In general, the distinction can be made between the person producing the data to be verified and the person verifying the data. The Project Manager will review all data resulting from this project to determine if it meets the QA Plan objectives. Data verification methods may include, but not limited to; reviewing field logs, chain of custody reports, sample preparation, sample shipping and billing information, laboratory logs books, laboratory reporting procedures, comparisons to

sample tracking. Any questionable results will be discussed with the reporting laboratory, field personnel or laboratory QA Manager.

Reference/Literature Cited

CH2M Hill, 1993. Stone Cabin Mine Final Environmental Impact Statement; Prepared for United States Environmental Protection Agency, United States Bureau of Land Management and United States Army Corp of Engineers. Vol. 1 and 2.

Hill, S, A. Cocrane, D. Williams, M. Luckey, K. Greenfield, R. Farles, B. Hudson, J. Tkachyk, D. Ugstad, P. Ugstad, and L. Wickam, 1973. Study ofmercury and heavy metals pollutants in the Jordan Creek Drainage. Silver City Project. Student Oreginated Studies, National Science Foundation. College of Mines, University of Idaho. Moscow, ID.

Kinross, Delamar Mining Company, 2005. Kinross Delamar Mine 2004 Water Quality Monitoring Report. Kinross Gold Coorporation. Jordan Valley, OR.

Koeber, S., 1995. DRAFT Report: Mercury in the Owyhee River basin: Oregon, Idaho and Nevada. Prepared for: Oregon Department of Environmental Quality, Mercury Working Group. Environmental Science Program, University of Idaho. Moscow, ID.

Mason, R., M. Abbott, R. A. Bodaly, O.R. Bullock, C.T. Driscoll, D. Evers, S.E. Lindberg, M. Murray, E.B. Swain, 2005. Monitoring the response to changing mercury. Environmental Science & Technology A-Page Magizine, Society of Environmental Toxicology and Chemistry,. (www/briloon.org/pub/doc/es&t/Monitoring%20the%20Response%20to%Changeing%20Mercury.htm)

Noren, K., G. Westoo. 1967. Var Foeda. 1967; 19: 13. IN: Hill et al.1972

Ralston, G. L. and M. L. Browne. 1976. Technical procedures manual for water quality monitoring. Bureau of Water Quality, Idaho Department of Health and Welfare-Division of Environment. Boise, ID.

Seronka, P. 1995. Studies related to mercury in the Owyhee River Drainage area. United States Department of Interior, Bureau of Land Management, Lower Snake River District. Boise, ID.

Stamenkovic, J., M.S.Gustin, M.C. Marvin-DiPasquale , B.A.Thomas, and J.L.Agee 2004. Distribution of total and methyl mercury in sediments along Steamboat Creek (Nevada, USA). Science of the Total Environment 322 (2004) 167–177

Ullrich, S., T.W. Tanton, and S.A. Abdrashitova, 2001. Mercfury in aquatic environment: A review of factors affecting methylation. Critical Reviews in Environmental Science and Technology. 31 (3):241-293.

U.S. EPA 1996. EPA Method 1669. Sampling ambient water for trace metals at EPA water quality criteria levels. United States Environmental Protection Agency. Office of Water. Washington DC.

U.S. EPA, 1998. Superfund Technical Assessment and Response Team (START). U.S. Environmental Protection Agency. Region X. Seattle WA.

U. S. EPA, 2000. Guidance for assessing chemical contaminant data for use in fish advisories. United States Environmental Protection Agency. Office of Water. Washington DC.

U.S. EPA , 2001. Water quality criterion for the protection of human health: Methylmercury. U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology. Washington, DC

U.S. EPA Personal Communication 2005. Helen Rudea. U.S. Environmental Protection Agency. Portland, OR.

APPENDIX A.

Additional Literature and Reference Material

APPENDIX B.

Field Forms, Chain of Custody Forms, DEQ Tracking Forms, DEQ Laboratory QA Forms

DEQ Fish Tissue Processing Laboratory Quality Control

Duties and Responsibilities

1. Preliminary check in of samples from field (FORM Lab-1)

a. Check to determine if the number of samples matches the chain of custody form
Check if individual samples are not compromised in ice chest (open bags)
b. Determine if samples are well iced and will maintain 4^{o}C for 8-12 hours, replenish ice if needed.
c. Secure ice chests with tamper proof tape
d. Secure ice chests
e. Review for completeness field forms submitted with samples, initial field form
f. Review Chain of Custody form and initial

2. Secondary Check in of Samples (FORM Lab-2)

a. Place non-mercury thermometer, or electronic probe in ice chest and record temperature after two minutes
b. Prepare laboratory check in forms for sample station
c. Identify individual fish sample identification and record on laboratory check in box
d. Cross check on field forms for sample identification
e. Identify whole body fish sample identification and record on laboratory check in box
f. Cross check on field forms for whole body sample identification
g. Sign chain of custody form

3. Sample Processing (Individual Samples) (Form Lab-3)

a. Lay out unopened individual samples, one group at time. Assign random number to each individual fish (i.e. Individual Sample Number is JC-2005-02-05, random number is 2).
b. Assign which random number is assigned to which composite sample. (i.e. Individual samples with random number 2, 7 and 10 are assigned to 1st composite, and composite identifier is JC-2005-02-(2,7,10)-1COMP. Or something like that. And so on, till all 10 fish are assigned to a composite.
c. Note any deformities or other amoralities on bottom of form. Fishery person will help. Next step can be taken two ways 1) get weight and length from all fish before filleting, or 2) collect weight and length then fillet individual fish. Which every way the lab personnel decide will be easiest.
d. Determine if there are any issues that may prevent filleting.
e. Check box if individual will be used.
f. Filet sample and remove a 70-80 gram plug of the fillet for composite.
g. Each plug is weighed and weight recorded
h. Place plug in the dish-plate identified for the assigned composite identifier.
i. Either fillet reverse side of sample and collect 70-80 gram plug for achieve, or use same fillet to collect the achieve plug. This will probably depend on how much meat and muscle you find on each fish. This is where the fishery person will need to step in.
j. Each plug is weighed and weight recorded

k. Place plug in the dish-plate identified for the assigned composite identifier. Remaining fillets will be placed in individual recloseable baggies, removing as much air as possible. A pre-printed label should be placed on outside of baggie with the following information:
l. Individual sample identification
m. Random number assigned
n. Composite identifier
o. Date and time of processing
p. Initial of Lab QA/QC Manager

q. Remaining fish carcasses set aside for gut content review after grinding is complete.
r. At this time you should have 6 composite samples identified, 3 for the first composite and 3 for the achieve. Number of plugs for each composite will be 3,3, 4.
s. Grind plugs for first composite (Composite #1), change grinding blade. Grind plugs for second composite (Composite #2)….and so on to the third composite. Grind samples into glass sampling container, or spoon out. Identify sample container with appropriate Composite Identifier.
t. Place sample on ice
u. Repeat with archive composites.
v. Examine gut content and note primary diet (if possible).
w. Repeat with second fish group for same station.

4. Sample Processing (Whole Body) (FORM Lab-5)

a. Whole body samples received in two groups, 1) Trout young of the year (YOY) and 2)
b. Sculpin. Each group to be completed separately.
Individual fish measured for length (within 5mm)
c. Approximately 20-30 fish will be required to complete a 200 gram composite.
d. Assign composite identifier, such as JC-2005-02-(YOYEPA)-WB-01, or something to that affect.
e. Two 200 gram samples will be required (if attainable), 1 set for EPA analysis and the second as archive.
f. Whole body fish are ground together completing one 200 gram composite sample,
g. Sample scooped or poured into appropriate glass container and sample container identify with appropriate composite identifier.
h. Place samples on ice
i. Remove blade and replace with clean blade.
j. Repeat for archive composite sample.

5.QA/QC Sample Replication Blank Rinse-Reagent (FORMS Lab-04, Lab-06 and Lab-08)

a. Blank rinse-reagent sample collect each day at beginning of sampling.
b. First rinsing of equipment at the beginning of processing the rinse-reagent liquid of filleting knives and grinder blades will be captured into a 250 ml glass container.
c. Sample bottle will be capped and labeled a (prepared label recommended):

lab blank-reagent wash

d. Sample Identification number
e. Date and Time
f. Collected by
g. Identify rinse-reagent (DI water…)
h. Replicate Samples (if inadequate sample remains for duplicate, use archive sample).
i. Date of replicate samples to be determined, only one replicate will be submitted for all 8 stations
j. Repeat step 3 item 1-20 (Archive composite not required)
k. Repeat step 4 items 1-10 (Archive composite not required)

6. Post Processing Sample Tracking (FORM Lab-07)

a. Complete Form Lab-07
b. Place all samples from the individual stations in separate container and freeze to -20^{o}C.
c. Separate chain of custody, EPA lab submittal forms and shipping information to be completed by Lab QA/QC Manager, DEQ QA Manager and Project Manager.

7.0 Decontamination-Clean Up and Laboratory Preparation

1. To be completed by Laboratory QA Manger and Lab Support personnel.

FORMS (Forms in Excel Format and will be secondary document)

APPENDIX C.

Proposed Budget

Table Appendix C. Proposed Budget for Fish Tissue Monitoring, Analysis and Equipment Needs. Jordan Creek Watershed.

Personnel Needs	Task	Number Required	Number of Hours Required	Average Costs Per hour	Total Cost Estimate Person	Total Cost
Tech Services	Fish Filleting	3	40	$ 35.00	$ 1,400.00	$ 4,200.00
BURP Crew	Water Sampling/Fish Collection/ Sediment Sampling	3	80	$ 25.00	$ 2,000.00	$ 6,000.00
Field Manager	Field Sampling Oversight	1	160	$ 30.00	$ 4,800.00	$ 4,800.00
Project Manager	Project Oversight	1	160	$ 35.00	$ 5,600.00	$ 5,600.00
Xin	Adequate Analysis for Fish	1	20	$ 35.00	$ 700.00	$ 700.00
Laboratory Preperation	Physical Preperation of Laboratory	1	30	$ 35.00	$ 1,050.00	$ 1,050.00
Total Personnel Estimate Cost						$ 22,350.00
Laboratory Needs						
Identified Lab Support	Task					
State Lab	Water Quality Analysis (attached)	12	5	$ 35.00	$ 2,100.00	$ 2,100.00
Contract Lab						
	Sediment					
	Methyl Mercury	16	1	$ 230.00	$ 3,680.00	$ 3,680.00
	Total Mercury	16	1	$ 115.00	$ 1,840.00	$ 1,840.00
	Total Solids	16	1	$ 15.00	$ 240.00	$ 240.00
	Water					
	Methyl Mercury	16	1	$ 200.00	$ 3,200.00	$ 3,200.00
Contract Lab Total						$ 8,960.00

Table Appendix C. (Continued) Proposed Budget for Fish Tissue Monitoring, Analysis and Equipment Needs. Jordan Creek Watershed

Hanacca	Periphyton Analysis	8	1	$ 420.00	$ 3,360.00	$ 3,360.00
Total Lab Support Estmate Costs						$ 14,420.00
Equipment Needs						
Item	Task					
YSI 565 Multiprobe/ Multiparameters	DO, Temperature, Conductivity, Redox and pH Field Measurements	1	NA	$ 3,500.00	$ 3,500.00	$ 3,500.00
Ceramic Knives	Fish Filleting	100	NA	$ 1.00	$ 100.00	$ 100.00
Tyvek coveralls	Clean Sampling Procedures	100		$ 3.00	$ 300.00	$ 300.00
Tyvek Booties	Clean Sampling Procedures	100		$ 0.70	$ 70.00	$ 70.00
Spare Electro-shocker Battery	Electro Fishing	1		$ 50.00	$ 50.00	$ 50.00
Sediment/Core Samplers	Sediment Sampling	10		$ 5.00	$ 50.00	$ 50.00
Nets	Electro Fishing	2		$ 25.00	$ 50.00	$ 50.00
Stun-Stick Bat	Humane treatment of Fish	1		$ 5.00	$ 5.00	$ 5.00
Collapsible Table	Clean Workspace	1		$ 25.00	$ 25.00	$ 25.00
Walkie Talkies (2 sets)	Communication	4		$ 12.00	$ 48.00	$ 48.00
Fish Grinder	Grinding Fish Samples	2		$ 50.00	$ 100.00	$ 100.00
Total Equipment Estimate Costs						$ 4,538.00
Misc. Needs	Item					
Zip-Loc Baggies	Storage for Fish/sediment Samples	20		$	$ 40.00	$

				2.00		40.00
Sterile/Disposable Scopes	Sediment Sampling	20		$ 1.00	$ 20.00	$ 20.00
Spoons Teflon Coated	Sediment Sampling	20		$ 1.00	$ 20.00	$ 20.00
Trash Bags	Misc. Uses	20		$ 1.50	$ 30.00	$ 30.00
Liquinox cleaner	Decontamination	1		$ 20.00	$ 20.00	$ 20.00
Aluminum foil	Fish Storage and Transport	1		$ 5.00	$ 5.00	$ 5.00
Wash Bottles	Misc. Uses	10		$ 1.00	$ 10.00	$ 10.00
Drop Clothes	Clean Field Work Space	15		$ 1.00	$ 15.00	$ 15.00
Ice/lbs	Sample Transportation	500		$ 0.10	$ 50.00	$ 50.00

Table Appendix C. (Continued) Proposed Budget for Fish Tissue Monitoring, Analysis and Equipment Needs. Jordan Creek Watershed

Dry Ice/lbs	Sample Transportation	200		$ 0.80	$ 160.00	$ 160.00
Liquid Detergent	Misc. Uses	1		$ 2.00	$ 2.00	$ 2.00
Bubble Wrap	Sample Transportation	1		$ 3.00	$ 3.00	$ 3.00
Sample Shipping	Sample Transportation	15		$ 80.00	$ 1,200.00	$ 1,200.00
Lab Construction Material	Plastic laydowns	1		$ 50.00	$ 50.00	$ 50.00
Total Misc. Estimate Costs						$ 1,625.00
Total Estimated Project Costs						$ 42,933.00